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(71) Applicant *(for all designated States except US)*: SCANVÆGT INTERNATIONAL A/S [DK/DK]; P.O. Pedersens Vej 18, DK-8200 Århus N (DK).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: JENSEN, Sven Bækhøj [DK/DK]; Skæring Sandager 133, DK-8250 Egå (DK).

(74) Agent: K. SKØTT-JENSEN PATENTINGENIØRER A/S; Lemmingvej 225, DK-8361 Hasselager (DK).

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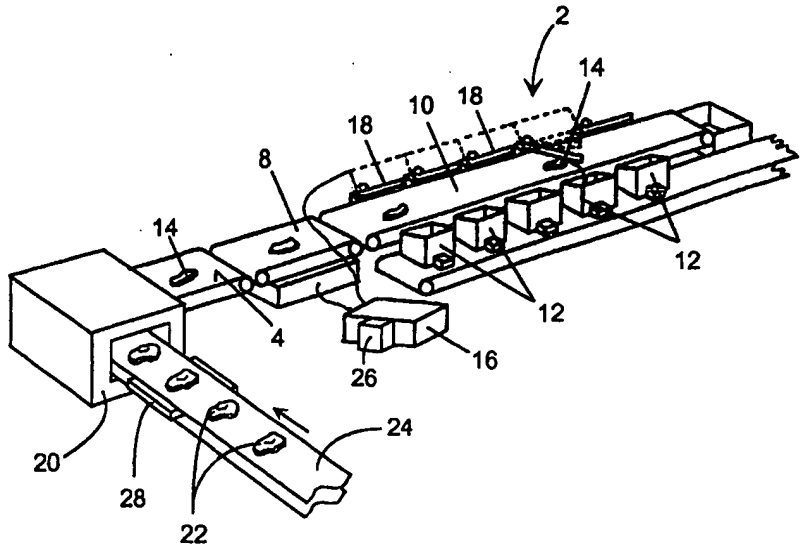

(57) Abstract

For the building up of weight determined batches of food-stuff items delivered from a processing machine such as a slicer or portion cutter, it is known to make use of special batching machines which, by selective weight-controlled merging of the items in a row of receiver stations, can build up batches of predetermined weight, even despite some weight spread in the flow of supplied items; however, the efficiency of the batching may be higher or lower according to the factual weight spread of the items. With the invention advantage is taken of a feedback function from the control unit of the batching machine to an adjustment unit of the processing machine, such that it becomes possible to influence the factual weight spread for optimizing the efficiency of the batching operation.

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A method and a system for providing weight-determined portions of foodstuff articles delivered from a processing machine such as a slicer.

The present invention concerns methods and means for providing weight-determined portions of foodstuff items which appear with a certain weight variation. For this purpose, special weighing apparatus has been developed which, on the basis of a delivered flow of items which are weighed in the apparatus, can group together precisely such items which together will form weighed-out portions with a desired, predetermined weight, and if required even with a predetermined number of items in each portion. In order to make this effective, it is well-known, cf. e.g. GB-C-156 033 and WO 96/08322, to make use of an assumption or knowledge concerning the weight distribution of the items in the arriving flow, in that this makes it possible from the point of view of control to collect items in part-portions which with a high degree of probability will be able to be built up to the desired target weight, i.e. by the addition of one or more of such items which are of a weight which appears most frequently in the delivered flow of items.

The actual portioning tasks should naturally be defined with due regard being paid to an expectable approximate weight of the actual items, so that on the whole it is realistic to aim at a certain target weight of the portions, e.g. of six whole fish fillets or a certain number of cut salmon slices. The smaller the number, the more critical it will be to work with a sensibly-determined target-weight range for the provision of a minimum of overweight and possibly even a smaller maximum of underweight, where underweight may generally be expected to occur in a certain percentage of the portions.

Work has hitherto been carried out on the basis of one or more smaller well-defined weight distributions of the arriving items, i.e. this weight distribution is taken for granted, though with the possibility of being able to adjust the basis for calculation for the portioning out in such cases where changes in the weight distribution are ascertained, e.g. as a consequence of a change between raw materials from different suppliers.

The present invention is primarily related to that situation in which the portioning plant is coupled after a processing unit such as a slicer or a so-called "portion cutter" for the dividing of passing items into larger or smaller individual pieces. These machine are arranged in such a way that they can be set basically to provide "product lengths", e.g. slices with a desired degree of thickness. Normally, such a setting will be of main significance, determined mostly by customer requirements, but with the invention it has been realised that it can be particularly important in this connection for a regulating function to be established between the control unit for the portioning unit and the control unit for the processing apparatus, i.e. so that it is possible to actively bring about a certain modest alteration in the weight distribution of the individual items with the view to achieving a good probability for a grouping of items of the desired target weight. This can be a question concerning the adjusting-in of deviations of such modest amount that the individual customer, upon the purchase of "retail packing", will hardly notice the difference, but where the same small changes will, however, mean that the producer, when the results of the many small changes are added together, can achieve a surprisingly great saving in the total overweight delivered.

The invention shall be seen in light of the fact that the arriving nature products do not have the character of a

uniform material string, but of units of varying thickness, whereby cut slices or pieces hereof will appear with different weights all depending on their size and thickness. The primary object of the adjustable processing apparatus is to enable the size or thickness of the pieces to be adjusted in accordance with general customer requirements regarding the different products, and by a further fine adjustment it will naturally be possible to adjust the portion weight of e.g. identical slices of cold meat, sandwich fillings or the like, to a desired "rounded" weight, but where the slices are of varying size, the effect of the fine adjustment intended herewith will be illusionary. The effect can perhaps be excellent during certain periods, but in other periods it can thus be directly inexpedient, because it will disturb the whole weight distribution pattern, and maybe hereby make it even more difficult for the portioning machine to produce item combinations for the target weight.

In practice, for the operator to be able to foresee these situations is excluded, but according to the invention the problem will still nevertheless be able to be solved, i.e. by making use of the calculation equipment for the portioning machine. It is already practised to let this or parallel equipment carry out simulated portioning with the view to determining whether these can possibly be optimised better by the selection of an easily-changed target weight range, and with the invention it has been realised that it will be correspondingly possible to carry out such simulations on the basis of such changes in the weight distribution, which will be able to be brought about by certain adjustments of the processing machine, and thereafter, via a regulation loop, effect such an adjustment which by signal processing is found to be the most suitable for the total portioning-out, with the object of minimising both overweight and re-circulation of unusable pieces.

It can be applicable alternatively to carry out corresponding determinations in a purely iterative manner, i.e. by "trial" adjustment changes and quick determination of the degree of the success of these changes with the view to the selection of the optimum adjustment. When such a decision has been made, new simulations or trial adjustments can then be initiated on the basis of the new adjustment, so that a relevant control measure can quickly be effected if changes occur in the weight distribution of the raw materials supplied, or if a change shall be made to a new target weight pattern.

The calculation unit must naturally be informed whether adjustments should only be carried out within certain limits, e.g. with reference to a permissible variation in the thickness of sliced meat, which naturally must neither be too thick nor too thin. However, work may well be carried out with a certain differentiation if, e.g., it is found that "small slices" can well be slightly thicker than "large slices", in that already at the weighing-in of the slices it can be automatically registered by weighing or scanning whether the slices are "large" or "small". It can thus depend on the given operational conditions whether it is realistic to work with such a differentiated control, in that regard must be paid here to the operative length of the regulating loop, in that a precondition for an effective regulation after "small slices" is that small slices are still being cut at the time at which the first of these reach forward to the weighing-in. This can point towards the placing of the weighing-in station immediately after the processing station, but an alternative can be to arrange means for the detection of the size of the pieces actually supplied in or immediately after the processing station. Such a detection can be effected in different ways, such as by a rough "tendency weighing", by vision inspection or by registration of a change in

the energy which is involved in the separation of the supplied pieces.

It will also be possible, however, to work with a main programming of the calculation unit on the basis of a special characteristic of the processed items, so that this unit is able to detect .e.g. whether a fish side is "short" or "long" and herewith "thick" or "thin", on the basis of an introductory registration of the increase rate and duration of the increase in weight which arises in connection with the first number of slices cut from such an item. It can thus also be predictable how long that piece of the item will be along which slice cutting with more-or-less uniform size can be expected, so that it is also predictable when and how long there will later come a series of slices of reduced size from such an item. The "nature products" involved can well be dissimilar in size and weight, but in respective series they will still display a relative uniformity in their structure, and knowledge of this can to a great degree be used in a sensible programming of the calculation unit.

On this basis, a further alternative will be to work with a weighing, possibly merely a rough weighing, of the items arriving at the processing station. When the calculation unit has been informed whether the items arriving are e.g. "salmon sides", a preceding rough weighing will already make it possible to pre-discount the thickness sequence of the item during the subsequent slicing, i.e. it will be relatively easy for the calculation unit to predetermine the natural changes in the thickness sequence which will occur during the subsequent cutting of the slices, and the said simulation unit can thus be kept informed concerning this.

Light is thus shed on this problematic as far as "slice cutting" of the arriving items is concerned, and what is left is to consider the cutting which takes place in the said "portion cutters". Here, this involves the cutting of larger

pieces of the supplied products such as cutlets or whole part lengths of salmon sides, but this will not radically change the disclosed aspect of the invention. There will merely be even more dependence in this connection on the input registration of the weight and shape of the supplied items, which can be achieved by use of a weighing and/or vision equipment coupled anteriorly. On the basis of the data registered hereby, the processing unit will be able to be controlled for producing such items which, later in the portioning-out sequence, will then have good possibilities via co-control of being combined in the formation of portions within the determined target weight conditions. In connection with the cutting-off setting, there will also be the possibility, based on vision detection, of taking into account that the cut-off pieces can be subjected to a processing such as the cutting-away of an edge of fat or cut-off pieces of bone by water-jet cutting before the portioning-out of the pieces. To a greater or lesser degree, also this will have an influence on the item weight.

It must be emphasised that the relevant adjustments are not effected with the view to a direct adjustment of the portion weight, which would be a normal picture of a controlling sequence, but rather to bring about such variations in the weight distribution that it is possible for the portioning apparatus to effect optimised bringing-together of items for the desired portion weight, i.e. with said adjustment as an indirect result. On this basis, it could also be relevant to control the processing machine in such a way that it constantly or in selected periods works with small variations in the cutting length, and hereby to give the portioning machine the possibility of working with a greater selection of different item weights.

It is an additional aspect of the invention that, e.g., in connection with the cutting of salmon into slices, it can

be chosen to break into a relevant portioning-out in such a manner that the algorithm which is used to produce suitable item groups for the building-up to the desired portion weight on the basis of the arising weight distribution, is provisionally suspended in favour of a another algorithm, i.e. for example the condition that each portion shall include a certain number of salmon slices which are more-or-less the same size and stem from one and the same fish. This is of importance for such slice packaging in which the slices are placed on a support plate in such a way that a certain part of some of the slices are visible through a "window portion" of a surrounding packaging of foil. Here, the presentation picture of the slices is quite important, and for precisely this reason the said model can be highly relevant, even although this means that a smaller overweight in the portions will have to be accepted in order to get these finalised.

This can thus involve that the portioning unit must be programmed to suppress "intelligent portioning-out" when slices of more-or-less the same size arise from one and the same item, and instead switch over to a slavish grouping of a certain number of successive slices in the same portion, regardless of whether these slices or some of them could perhaps be more suitable for the building-up of one or more other portions.

This principle can with advantage be practised in general, i.e. without depending on a special control of a process unit coupled anteriorly, but it will be understood that precisely such control possibilities can be of special significance when the problem arises that a certain part number of items or slices are subjected to special portioning-out conditions which do not conform with the regard for the perfect weight build-up, so that after this forced part build-up only relatively few items will be required for the final build-up of the individual portions. It will hereby be made

relevant that the remaining items or slices should be added in weight-determined form for the completion of the portions to the desired weight.

It is mentioned here that it can be desirable to interrupt a portioning-out sequence with criteria other than precisely the ideal weight build-up, and it must be understood that there can hereby be many other significant factors than just the size or the appearance of the individual items which can be decisive for the provisional suspension of the ideal weight control, e.g. if it is prescribed that, e.g. in each portion of twenty items there shall be three items of a type which vary significantly from the primary items, and which appear only in modest amounts in the supplied flow of items. Here there can thus be arranged a forced intervention in the building up of the individual portions for the incorporation of the secondary items, completely or almost without regard to whether the weight of these items is particularly suitable for the weight build-up of the respective individual portions. This should take place so quickly for each portion that there is continued possibility for a final build-up of each of the portions to the desired target weight by the inclusion of a majority of the primary items.

The invention will now be explained in more detail with reference to the drawing, where

fig. 1 is a schematic perspective view of a system according to the invention, and

fig. 2 shows the weight distribution curves.

The drawing shows an example of a portioning apparatus 2 of the grader type 2 with a supply conveyor 4, a dynamic weighing-in unit 8 and a lead-out conveyor 10, along which there are a number of receiving stations in the form of containers 12 which can be selectively provided with the items 14 which pass the weighing-in unit 8. This has a control unit 16 which can activate sweeper arms 18 opposite the individual

containers 12 for weight-controlled grouping of items 14 in said containers, primarily for building up item portions of a fixed weight. When such a build-up in each individual container is completed, this can be emptied, preferably by the opening of a not-shown bottom flap, after which the container can again immediately be supplied with items for the building up of a new portion.

It is also shown that here the supply conveyor 4 feeds items 14 from a processing machine 20, which is fed with items 22 e.g. from a supply belt 24. These items 22 are natural foodstuff items such as fish sides or various pieces of meat for further cutting up, i.e. the items involved can appear with more-or-less varying sizes and with varying cross-sectional shapes. The processing machine 20 can be a slice cutter or a "portion cutter", or for that matter any other unit which in a controllable manner has influence on the weight of the items 14 to which the items 22 are converted in this unit. In that the items 22 are not of completely regular shape, unlike e.g. formed pieces of sausage, the weight of the processed items 14 will consequently vary depending on whether they stem from a thick of a thin piece of the items 22.

The control unit 16 is programmed in a known manner for providing item groups in the containers 12 on the basis of information concerning the weight distribution in the flow of supplied items 14, in that it is thus possible relatively quickly to build up part portions which for completion to a target weight lack only one or a few items of the kind which there are most of, so that the final build-up can also be effected quite quickly.

The occurring item weight distribution and knowledge of this will thus be of decisive importance for the efficiency of the apparatus, and while one has hitherto had to be satisfied with the work being carried out on the basis of an ex-

pected or ascertained weight distribution, it will thus now be possible to bring about a desirable change in the weight distribution by a feedback to the control arrangement in the processing apparatus 20. This can be controlled from a simulation unit 26 in connection with the control unit 16, in which unit 26 it is currently detected to what degree it can be relevant to change the function of the processing apparatus 20 in order to bring about a new weight distribution of the items 14, which with increased efficiency will improve the chances for quicker grouping together of the items 14 into portions of the desired target weight.

It is illustrated in fig. 2 that an occurring weight distribution WD1 can be changed to a distribution WD2, shown with the stippled line, if by use of a slice cutting machine a setting is made to slightly smaller thickness. The weight range will be moved slightly downwards, and the number of items (n) will increase, whereby the basis on which control unit 16 brings about item grouping to the desired portion weight is revised, and it is the effect of such displacements which can be evaluated in the simulation unit 26.

In fig. 2 the curves WD are shown as approximately normal distribution curves, but it must be taken into consideration that a weight distribution which actually arises will depend strongly on whether e.g. a slice cutting machine is in the process of cutting-up a section of a supply item 22 with increasing or decreasing thickness. With the cutting-up of sections with constant thickness, the weight distribution will not be "natural", since the weight of the slices of any slice thickness will thus be almost identical. As already discussed, it is therefore decisive that it is detected, or determined in another way, how the weight distribution can be expected to change at such short notice that such a change is able to have influence on the combination possibilities with which the portioning machine is actually able to work.

It can hereby be expedient that the size of the supply items 22 is determined by the passing of a weighing unit 28 or by vision equipment, so that the unit 16, 26, on the basis of programmed knowledge of the thickness sequence of the relevant kind of item, can adapt itself to an expectable variation sequence of the item thickness.

As already mentioned, it can be desirable to exercise influence on the effective weight distribution in the indirect manner, i.e. that in certain periods the control which is carried out on the basis of the weight distribution is suspended, and use is made instead of one or more other criteria as basis, e.g. a forced allocation of immediately succeeding slices to the same portion. This has no particular influence on the apparatus, and it is not illustrated in detail in the drawing. Moreover, this form of control will not necessarily be limited to the simultaneous control after the displacements in the weight distribution have been dealt with.

C L A I M S

1. Method for building up weight-determined portions of foodstuff items which are delivered from a processing machine such as a slice cutter which is fed with pieces of natural foodstuffs of varying thickness, said items being fed successively to a weighing and portioning machine which, on the basis of registered item weight, carries out a selective grouping-together of items in the formation of portions with predetermined weight, controlled by a calculation and control unit which also receives information concerning a registered or expectable weight distribution of the delivered items, c h a r a c t e r i z e d in that the control unit is operatively connected to an adjusting arrangement in the processing machine, and is hereby arranged to bring about such changes in the processing which have influence on the weight of the delivered items in such a manner that the actual weight distribution is adjusted with the object of optimising the efficiency of the portioning machine.

2. Method according to claim 1, whereby in the control unit there is continuously effected simulated portioning-out for evaluation of the efficiency of such changes in the weight distribution of the items, which in an acceptable manner will be able to be brought about by influence on the processing machine's adjusting arrangement.

3. Method according to claim 1, whereby in an iterative manner, the control unit effects changes in the adjustment of the processing machine for evaluation of the efficiency of associated changes in weight distribution.

4. Method according to claim 1, whereby a determination of the size of the pieces arriving at the processing machine is carried out, and that this information is fed into the control unit which, on the basis of information concerning general variation conditions in the mass distribution of

pieces of the actual type, pre-calculates the expectable changes which are soon to occur in the weight of the items which are currently separated from the arriving piece.

5. Method according to claim 1, whereby the control is exercised in such a manner that the control on the basis of the weight distribution is suspended or rendered inoperative in part periods in which predetermined conditions arise for the leading out of certain items to certain receiving stations or conditions for use of a changed portioning-out algorithm, regardless of whether this is suitable for the accumulation to the desired portion weight.

6. System for providing weight-determined portions of foodstuff items which are delivered from a processing machine such as a slice cutter, said slice cutter itself being fed with larger pieces of natural foodstuffs such as whole sides of fish, in that the separated items are successively fed to a weighing and portioning machine of the type which, on the basis of the registered weight and by means of an associated control unit, is operable to group items together into portions with predetermined target weight, c h a r a c t e r i z e d in that said control unit is operatively connected to an adjusting arrangement in the processing machine which can be influenced for changing the size/weight of the separated items, and that by such influences the control unit is arranged to influence the weight distribution of the delivered flow of items with the object of optimising the efficiency of the portioning machine.

7. System according to claim 5, where provided in the supply to the processing machine there is a unit for size determination and possibly type determination of the foodstuff pieces delivered hereto, and that this unit is connected to the control unit which is programmed to recognise the relative mass distribution in pieces of the relevant kind, and on this basis to pre-calculate the variation sequence for the weight of the items successively separated from this piece.

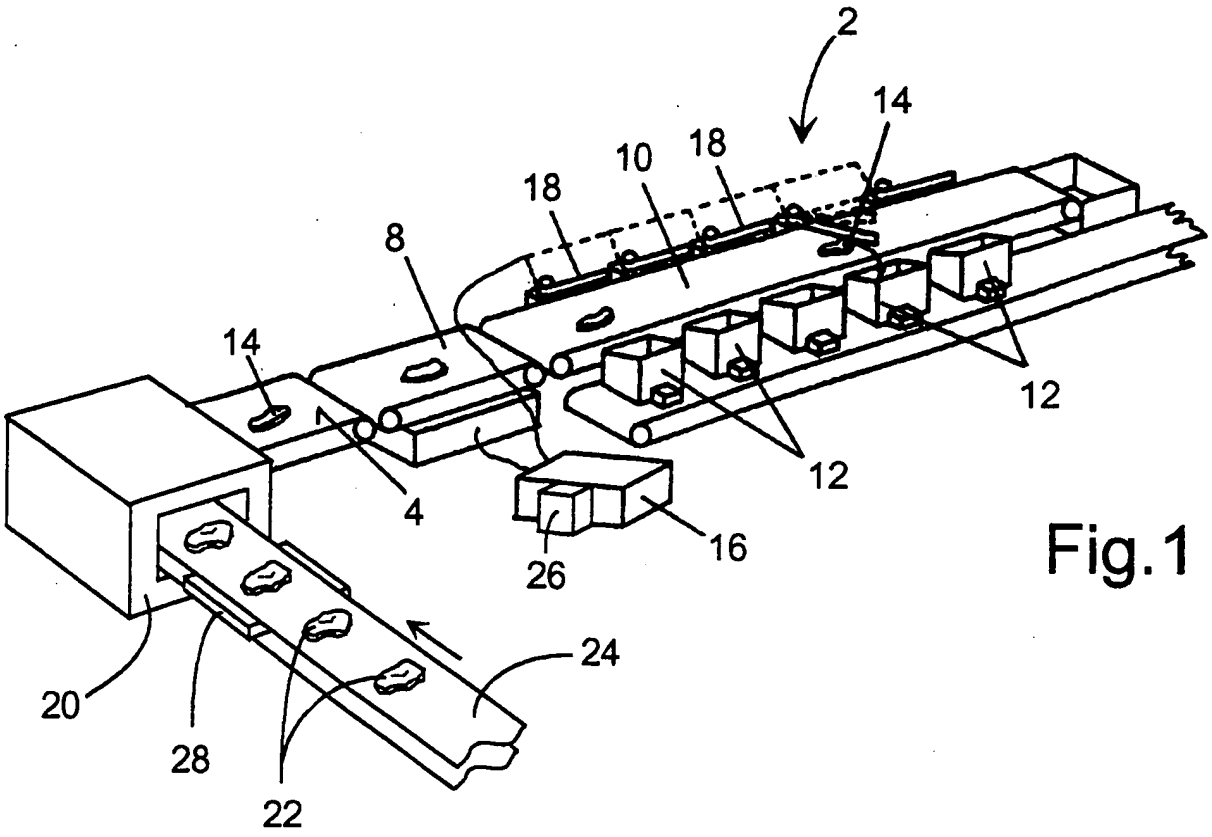

Fig.1

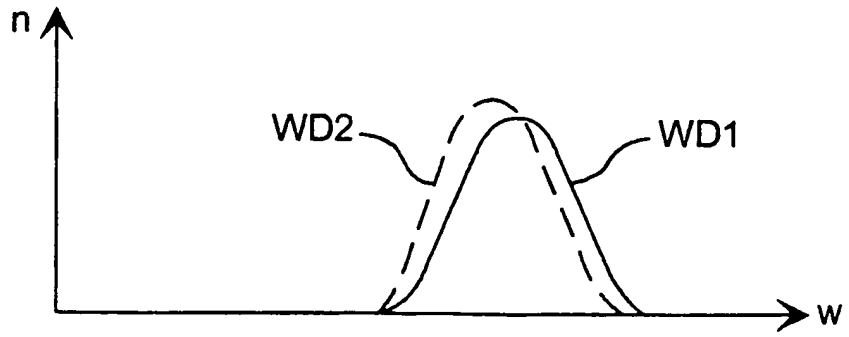

Fig.2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 99/00365

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A22C 25/18, B07C 5/18
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A22C, B07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9525431 A1 (SCANVAEGT A/S), 28 Sept 1995 (28.09.95) --	1-7
A	WO 9608322 A1 (SCANVAEGT A/S), 21 March 1996 (21.03.96) --	1-7
A	GB 2116732 A (KNUD DALGAARD AND CO A/S), 28 Sept 1983 (28.09.83) -- --------	1-7

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Date of the actual completion of the international search	Date of mailing of the international search report
17 November 1999	26 -11- 1999
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM	Authorized officer Åke Olofsson / MR

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/11/99

International application No.
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